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THE ASPARAGUS BEETLES AND THEIR CONTROL

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ASPARAGUS GROWERS in large sections of the United States now have to protect their crop against the attacks of the adults and young of two species of beetles introduced originally from Europe. These insects feed on the young and tender asparagus shoots and render them worthless for the market. Later broods devour the foliage and frequently kill the plants.

This bulletin gives brief descriptions of the various stages of these pests, tells how they live and work, and gives suggestions for controlling them. Of remedial measures the best for general use is shown to be spraying with arsenate of lead, directions for the preparation and application of which are given on pages 10–11.

THE ASPARAGUS BEETLES AND THEIR CONTROL.

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ALTHOUGH introduced into this country from Europe by the early settlers, asparagus is believed to have been cultivated here for two centuries before it was troubled by insects. Several species of native American insects, it is true, feed upon this plant, but none, so far as we know, has become sufficiently attached to it to cause serious injury. Few of our edible plants, indeed, down to the time of the Civil War have enjoyed such immunity from insect ravages.

In the Old World, however, two insects called asparagus beetles have been known as important enemies of this crop since early times. One of these, known as the common asparagus beetle, was introduced into Greater New York about 1860, while the other, the twelve-spotted asparagus beetle, sometimes called the red asparagus beetle, to distinguish it from the blue or common species, was first discovered in this country on asparagus in 1881 near Baltimore, Md. Both of these are now firmly established and widely distributed in this country and require special measures for their control.

THE COMMON ASPARAGUS BEETLE.[1]

GENERAL APPEARANCE OF BEETLE AND CHARACTER OF INJURY TO PLANTS.

The adult of the common asparagus beetle is a beautiful insect, slender and graceful, blue black with red thorax and lemon-yellow and dark-blue wing-covers having a reddish border. A common form about the District of Columbia is illustrated in figure 1, *a*. Farther north the prevailing form is darker, the lighter coloring sometimes showing only as a reddish border and six small submarginal

[1] *Crioceris asparagi* L.; order Coleoptera, family Chrysomelidae.

yellow spots. (Fig. 2, *a*.) An extreme, light form, not uncommon in the southern range of the insect, is shown for comparison in figure 2, *b*. The length of the body is a trifle less than one-fourth inch. The full-grown larva, or grub (fig. 1, *d*), is dark gray or olive, sometimes lighter but not infrequently very dark. Its head and legs are shining black and its body is soft and fleshy and much wrinkled. The pupa, or resting stage, shown in figure 1, *e*, is yellowish.

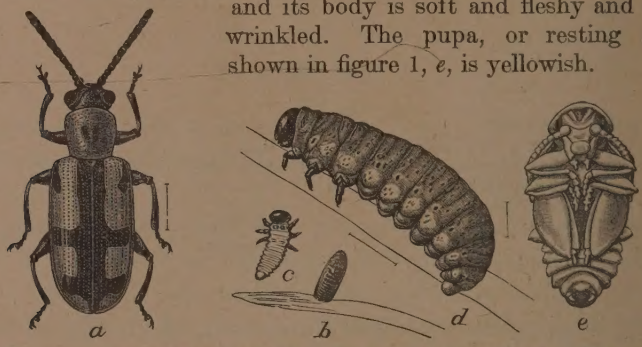

FIG. 1.—The common asparagus beetle: *a*, Beetle; *b*, egg; *c*, newly hatched larva; *d*, full-grown larva; *e*, pupa. All enlarged.

Injury by this insect is due to the work of both adults and larvæ, or "slugs," to the tender shoots, which they render unfit for market early in the season. Later they destroy by defoliation the high-grown plants, particularly seedlings, the roots of which become weakened when their tops are devoured. The larvæ are sometimes so abundant that the black molasseslike fluid which exudes from their mouths soils the hands of those engaged in bunching the stalks for market, and the eggs are sometimes laid upon the stalks in such numbers that the latter are rendered unsightly and even slippery by their presence. Larvæ, as well as beetles, attack the tenderer portions of the plants, but the beetles gnaw the epidermis, or rind, of the stems, seemingly with equal relish. The beetles are also accused of gnawing young shoots beneath the surface, causing them to become woody and crooked in growth. (See illustration on title-page.)

FIG. 2.—The common asparagus beetle: *a*, Dark form of beetle; *b*, light form. Enlarged.

In some localities it is in the establishment of new beds that the greatest trouble and expense are incurred. The plants must grow a year as seedlings and two more in the beds before being cut for table use, and during these three years they are exposed to the attacks of this insect.

DISTRIBUTION AND MEANS OF SPREAD.

The common asparagus beetle was introduced at Astoria, near New York City, about 1856. From there it soon spread to the asparagus farms in Queens County, N. Y., and by 1862 was reported to have occasioned the destruction of more than one-third of the crops in certain localities, the loss being estimated at $50,000.

To date the common asparagus beetle has been reported in 19 States and the District of Columbia and in several localities in Canada. Its known distribution now extends from Toronto, Canada, through New York and New England, except Maine, to southern North Carolina and westward to the border line between Illinois

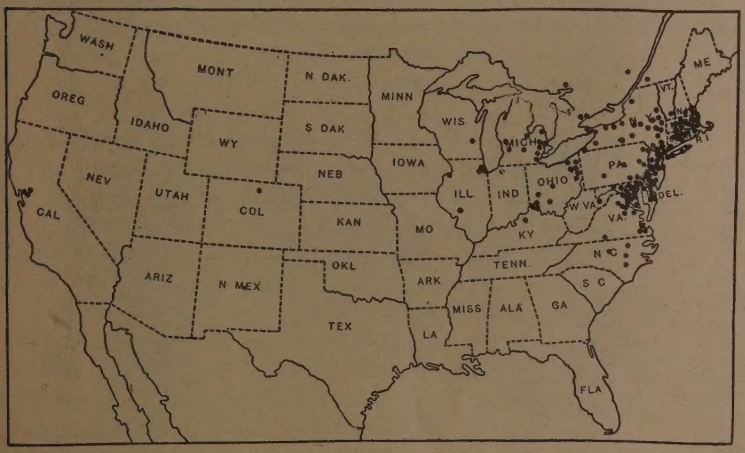

FIG. 3.—Map showing distribution of the common asparagus beetle in the United States and Canada as recorded up to the year 1917.

and Iowa, and in addition it has been reported from one locality, Boulder, in Colorado, and three in California. (See fig. 3.) Undoubtedly many localities in addition to those shown on the map will be added in time, for it is rather certain that the insect occurs elsewhere in Canada and in some of our States, such as Maine, Iowa, Wisconsin, and Illinois. This species appeared at Bouldin Island, Cal., in 1904, but disappeared subsequently, probably owing to the fact that the island had been flooded, causing the extermination of the pest.

The common asparagus beetle has been widely disseminated mainly by what are termed "commercial jumps," either through the presence of hibernating beetles and pupæ in shipments of propagating roots or by the accidental carriage of the beetles on railroad trains or boats.

The natural spread of the insect has been mainly by the flight of the beetles. Undoubtedly, also, the beetles have been carried from

place to place along watercourses by the current and by the rising and falling of the tide. Until recently this insect has not spread far from the seacoast and the larger rivers near the coast. As is well known, asparagus was originally a salt water plant, and has escaped from cultivation and grows most luxuriantly near bodies of water, and it is upon wild asparagus plants that this insect first makes its appearance in new localities.

HABITS AND DEVELOPMENT.

The common asparagus beetle passes the winter in the adult state under convenient shelter, such as piles of rubbish, sticks, or stones, or under the loose bark of trees and fence posts. Toward the end of April or in May, according to locality, at about the season for cutting the asparagus for market, the beetles issue from their hibernating quarters and lay eggs for the first brood.

FIG. 4. — Eggs of common asparagus beetle on asparagus buds. Somewhat enlarged.

The egg is very large in proportion to the beetle, being nearly a sixteenth of an inch in length, and of the elongated-oval form illustrated at *b*, figure 1. It is nearly three times as long as wide and of a dark-brown color. The eggs are deposited endwise upon the stem or foliage and, in early spring, on the developing stalks, usually in rows of 2 to 7 or more. (Fig. 4.)

In from 3 to 8 days the eggs hatch, the young larvæ, commonly called "grubs," "worms," or "slugs," presenting the appearance indicated in figure 1, *c*. The head of the newly-hatched larva is large, black, and beadlike; its body is lead gray, and its three pairs of legs black. It begins to feed at once and in from 10 days to a fortnight attains full size, appearing as in figure 1, *d*. As previously stated, it is soft and fleshy, much wrinkled, and of a dark gray or olive color, sometimes light, but not infrequently very dark. The head is shining black, as are also the 6 legs. Each segment is provided with a pair of footlike tubercles which, with the anal prolegs, or false hind legs, assist it in crawling and in clinging to the plant. The mature larva enters the earth, and here, within a little rounded, dirt-covered cocoon formed by it, changes to a yellowish pupa (fig. 1, *e*). In 5 to 8 or more days this transforms to the adult beetle, which in a short time issues from the ground.

THE LIFE CYCLE.

The life cycle, or the time from the laying of the egg to the emergence of the adult, or beetle, covers about 30 days on Long Island, N. Y., but this period will be shorter in the hotter part of the season than in the cooler days of May and June.

During a hot period at Washington, D. C., eggs that were laid on August 5 hatched on the 8th, or in 3 days. A larva that transformed to pupa on August 4 became adult August 9, or in 5 days. Allowing 10 or 12 days as a minimum period for the larva stage, 2 days for the larva to enter the ground and form its cocoon, and 2 or 3 days more for the beetle to mature and leave the earth, the insect is again ready to attack its food plant and to continue the reproduction of its kind in about 4 weeks from the time that the egg is laid.[1] This may be fairly taken to represent the minimum midsummer life-cycle period of the species in the District of Columbia and southward, since the insect does not thrive in the summer season of tidewater Virginia. In the colder climate of New England, and elsewhere in spring and autumn weather, the development from egg to beetle will require from 4 to perhaps 7 weeks.

FIG. 5.—The spotted ladybird, an enemy of the common asparagus beetle: *a*, Larva; *b*, empty skin of pupa; *c*, adult with more enlarged antenna above. Much enlarged.

The hibernating beetles appear in the latitude of the District of Columbia as early as April and beetles of a later brood have been observed in abundance in October, as far north as northern Connecticut. In its northern range usually at least two generations are produced, and farther south there is a possibility of three or four generations each year.

NATURAL CHECKS.

Predacious insects of many kinds attack and devour the larvæ of the common asparagus beetle and assist very materially in preventing the beetle's increase. One of the most efficient is the spotted ladybird.[2] This beetle (fig. 5, *c*) is rose colored, with numerous black spots. The convergent ladybird,[3] the spined

[1] On Long Island it has been found by the Bureau of Entomology that the combined length of the larva and pupa stages varies from 17 days in August to 46 days in October and November.

[2] *Megilla maculata* DeG.;

[3] *Hippodamia convergens* Guér.

soldier-bug,[1] and the bordered soldier-bug [2] (fig. 6) are also active destroyers of asparagus-beetle larvæ, which they attack by impaling them upon their long beaks and sucking out their juices. Certain species of wasps [3] and small dragonflies [4] also prey upon the asparagus-beetle grubs. These insects hover about the infested plants until a larva is seen, when they pounce upon it and carry it away. The eggs of this asparagus beetle are attacked by a minute wasplike four-winged fly[5] (fig. 7) which lays its eggs in those of the beetle. Strangely enough, the parasitized eggs hatch and the larvæ emerging from them become full grown, but are destroyed by the parasite larvæ after the beetle larvæ have entered the soil and formed their pupal cells, but before they have changed to pupæ.

FIG. 6.—The bordered soldier-bug an enemy of the common asparagus beetle: *a*, Adult bug; *b*, young bug, or nymph. Much enlarged.

Asparagus beetles are very susceptible to sudden changes of temperature, and it has been noticed frequently at Concord, Mass., that immense numbers of the hibernating beetles are killed in winter during severely cold spells following "open" weather, millions of their dead bodies sometimes being found under bark and in other hiding places.

FIG. 7.—*Tetrastichus asparagi*, a parasite of the common asparagus beetle: Adult. Greatly enlarged. (F. A. Johnston.)

The intense heat that prevailed at times during the summer of 1896, especially during the first two weeks of August, though conducive to the undue propagation of some forms of insects, had the opposite effect upon certain species that feed in the larva condition freely exposed upon

[1] *Podisus maculiventris* Say.
[2] *Stiretrus anchorago* Fab.
[3] *Polistes pallipes* Lep.
[4] *Ischnura posita* (Hagen).
[5] *Tetrastichus asparagi* Cwfd.

the plants. In the vicinity of the District of Columbia this was particularly noticeable in the case of the larvæ of this asparagus beetle. Its eggs, also, seemed to be dried up by the heat. What with the decimation caused by their natural enemies and that caused by the heat, scarcely a beetle or larva was to be found that year after the last of August.

METHODS OF CONTROL.

Fortunately the common asparagus beetle is not difficult of control and ordinarily may be held in repression by the simplest means.

GARDEN REMEDIES.

Hand-picking is of some value in small beds but must of necessity give way to more approved methods for the vast numbers of the beetles that concentrate their forces upon the large areas devoted to this crop in the suburbs of our large cities.

Chickens and ducks are efficient destroyers of asparagus beetles, and as they do no injury to the plant their services are still in requisition for this purpose at the present day.

One of the best remedies against the larvæ is fresh, air-slaked lime, dusted on the plants in the early morning while the dew is on. It quickly destroys all the grubs with which it comes in contact.

Pyrethrum is credited with being useful, and a mixture of soft soap, quassia decoction, and water (about equal parts of the first two to five of the last) is effective against the larvæ.

These remedies, with the exception of air-slaked lime to destroy the larvæ, hardly commend themselves for use on a large scale.

CULTURAL PRACTICES.

A practice in high favor among prominent asparagus growers is to cut down all plants, including seedlings and volunteer growth, in early spring, so as to force the parent beetles to deposit their eggs upon new shoots, which are then cut every few days before the eggs have time to hatch for the first new brood.

Other measures that have been employed with advantage consist in cutting down the seed stems after the crop has been harvested, and again once or twice during the cutting season, or in permitting a portion of the shoots to grow and serve as lures for the beetles. Here these may be killed with insecticides, or the plants, after they become covered with eggs, may be cut down and burned, and other shoots allowed to grow up as decoys. The trap plants should be destroyed as often as once a week. Naturally when the insects have congregated on the tips early in the cutting season, arsenicals and other substances can not be applied and it is necessary, therefore, to cut as deeply and as often as possible without injuring the product for the market.

With concerted action on the part of growers in following out these methods the insects may be held in check in regions where asparagus does not grow wild in too great profusion; elsewhere insecticides must be used. It is well in any case to employ insecticides after the cutting season, since if the insects are destroyed at this time their numbers the next year will be lessened.

THE BRUSHING METHOD.

A simple and inexpensive method of killing the larvæ in hot weather is to beat or brush them from the plants with a stick so that they will drop to the bare ground. The larvæ are delicate creatures, and, as they crawl very slowly, few are able to regain shelter of the plants, but die when exposed to the heated earth.

DUSTING WITH ARSENICALS.

An arsenical, applied dry mixed with flour, as for potato beetles, answers well as an insecticide, destroying beetles as well as grubs, and is of value on plants that are not being cut for food. A mixture of arsenate of lead and air-slaked lime, or plaster, 4 pounds of the former to a barrel of the latter, is recommended. For satisfactory results the lime and arsenical must be applied at frequent intervals, or as often as the larvæ reappear on the beds.

SPRAYING WITH ARSENICALS.

Arsenate of lead has given better results in spraying than any other arsenical. This insecticide has come into very general use in recent years and has superseded Paris green and other arsenicals for the control of leaf-feeding beetles, such as the potato beetles and asparagus beetles. It is less harmful to growing plants and less likely to burn the leaves, adheres better to the foliage, is less troublesome to prepare, and is more effective.[1] In addition the spray, on drying, leaves a white coating on the plants, so that it can be readily determined which plants have been treated and which have not.

Two pounds of dry lead arsenate, or 4 pounds of lead-arsenate paste, to 50 gallons of water or Bordeaux mixture will make a solution of sufficient strength to destroy asparagus beetles and their larvæ. The number of sprayings to be applied depends on local and seasonal conditions. Sometimes a single spraying at the proper time will suffice, but occasionally two or three applications are necessary, especially if rainfall intervenes. The adhesiveness of the spray material is promoted by the addition of about the same amount, by weight, of resin-fishoil soap as of the arsenical used.

[1] In Pennsylvania a comparative test was made of the value of Paris green and arsenate of lead, showing that not more than 50 per cent of the insects were killed when Paris green and lime were used, while 90 per cent were killed with arsenate of lead; and when resin soap was added to the arsenate of lead to make the latter adhere more closely to the plants, *all* of the insects were killed on 50 plants treated. In the last experiment the arsenate of lead was used at the rate of 2 pounds to 50 gallons of water, with 5 pounds of resin soap.

SPRAYING APPARATUS.

Extensive experiments have proved that for economy and efficiency the best spraying machinery should be used, even though its initial cost is greater. The "vermorel," "cyclone," and "giant-disk" types of nozzles are the most effective as well as the most economical. When the arsenical is forced through a nozzle of any of these types the spray is mistlike in appearance and adheres to the foliage instead of forming small drops which may roll off. A sprayer of the compressed-air type is the best, the smaller ones being operated by hand and the larger ones by machinery driven by horsepower.

THE TWELVE-SPOTTED ASPARAGUS BEETLE.

A somewhat less injurious species than the preceding is the twelve-spotted asparagus beetle [1] known to many growers as the red species. It is generally distributed in Europe, where it is apparently native, and, although common, not especially destructive. Like the preceding, it lives exclusively on asparagus, and its chief damage is due to the depredations of the hibernated beetles in early spring upon the young and edible asparagus shoots. Later generations attack the foliage, living, for at least a considerable portion of the larva stage, within the ripening berries.

INTRODUCTION AND SPREAD IN THE UNITED STATES.

The presence of this insect in America, as has been stated, was first discovered in 1881 in the vicinity of Baltimore, Md. This beetle was noticed in considerable numbers from the first, showing that it had probably been introduced several years earlier. It was then seen only on volunteer asparagus growing on the salty margin of a river, although beds of cultivated asparagus were plentiful in the immediate vicinity. Two years later it had proved even more troublesome than the common asparagus beetle.

It has been said of this species that it is one of the most interesting insect pests of which we have knowledge. Its mysterious introduction into the United States, the discovery of its presence in Baltimore, the rapid spread from that center, the keen race northward with the common species, their simultaneous arrival in Canada and progress westward, are only a few of the interesting phases of the history of the twelve-spotted asparagus beetle. Nearly every year since then it has been reported in new localities in the United States and Canada, until now it is well distributed westward and northward. In the Niagara peninsula the two species arrived almost simultaneously, the twelve-spotted form being the dominant one.

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[1] *Crioceris duodecimpunctata* L.

DESCRIPTION, SEASONAL HISTORY, AND HABITS.

The mature beetle (fig. 8, *a*) rivals the common species in beauty, but may be distinguished by its much broader back and orange-red color. Each wing-cover is marked with 6 black dots, and the knees and a portion of the under surface of the thorax are marked with black. The beetle, as it occurs on the plant when in fruit, very closely resembles at a little distance a ripening asparagus berry.

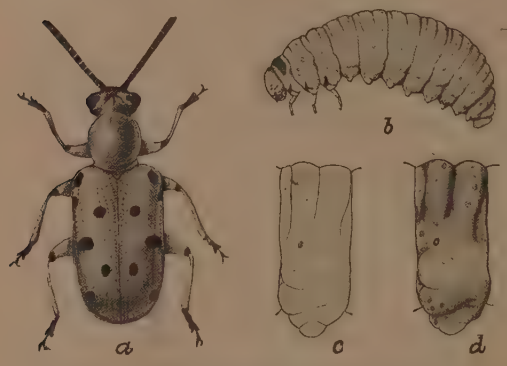

FIG. 8.—The twelve-spotted asparagus beetle: *a*, Beetle; *b*, larva; *c*, second segment of larva; *d*, second segment of larva of the common asparagus beetle. *a*, *b*, Enlarged; *c*, *d*, more enlarged.

The common asparagus beetle dodges around a stem like a squirrel when disturbed, but the twelve-spotted form appears to trust to flight, taking wing more readily. Both species make a loud creaking sound, when handled produced, in the present species, by rubbing the tip of the abdomen against the wing-covers.

The full-grown larva (fig. 8, *b*) measures, when extended, three-tenths of an inch (8 mm.), being of about the same proportions as the larva of the common species, but is readily separable by its orange color. The ground color is light yellowish cream with an overlay of yellowish orange which is most pronounced on the outer portions of the abdominal segments. The head, with the exception of the mouthparts, is also yellowish. The thoracic plate is prominent, divided into two parts, and of a dark-brown color. The second abdominal segments of both species, much enlarged, are shown for comparison at *c* and *d*, figure 8.

FIG. 9.—Eggs of the twelve-spotted asparagus beetle: At left, much enlarged; at right, nearly natural size.

The chief damage inflicted by this species results from the work of the hibernated beetles in early spring upon the young and edible asparagus shoots. Later beetles as well as larvæ appear to feed exclusively on the berries. In Europe this species, although common, is not especially destructive.

The eggs are deposited singly, and apparently by preference upon old plants, toward the ends of shoots which, lower down, bear ripening berries, and they are attached along their sides (see fig. 9)

instead of at one end, as with the common species. Soon after the larva hatches it finds its way to an asparagus berry, enters it, and feeds upon the pulp. In due time it leaves this berry for another one, and when full grown it deserts its last larval habitation and enters the earth, where it transforms to the pupa and afterwards to the beetle. The life cycle does not differ materially from that of the common species, and probably the same number of generations are developed, or nearly as many.

REMEDIES.

The remedies for the twelve-spotted asparagus beetle are those indicated for the common asparagus beetle, with the possible exception of the caustic lime and some other measures that are directed solely against the larvæ of that species, but the habit of the larva of living within the berry places it for that period beyond the reach of insecticides. The collection and destruction of the asparagus berries before ripening might be a solution of the problem, but it is questionable if recourse to this measure would be necessary, save in case of an exceptional abundance of the insect. A thorough spraying with arsenate of lead as advised for the common species should be sufficient for its control.

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